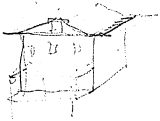
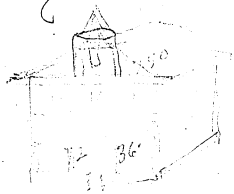
Notebook, N-01-04-01

This undated notebook was probably used sometime during the period 1901-1904, although the entries at the end of the book may have been added at a later date. All entries are by Edison. The book contains notes and drawings regarding storage battery experiments, including a list of possible explanations for low power output from the cells and a set of cost calculations for a competitor's automobile battery. There are also entries describing various methods for electrochemically extracting silver from nickel-cobalt ores. Near the end of the book are several drawings that could be preliminary sketches for Edison's concrete houses. The front cover is labeled "Very Important." The pages are unnumbered, and several pages have been removed from the book. Approximately 140 pages have been used.



Battery



Probable Causes of low Amp efficiency

1st = Some impurity in solution which is oxdzd & circulates & is reduced within the solution thus absorbing amp & doing work within the liquid probably as heat; I wonder if this would require any voltage. Could we have a large amp & scarcely any voltage & thus fool ourselves with Zn Zn & SulZn, there may be large amperage & scarcely any voltage,

2nd There may be some solid impurity in MnO_2 or Fe_2O that is oxdzd & reduced absorbing amperage (?) having work done on it — giving back nothing

3rd In the poss. of the Electrodes H may be free or absorb O requiring an amperage to give O but this is not nitric free to show growing but combines with the H in the water or vice versa O in the water H set free by C combines to form water

4th: The early growing of the iron may represent nearly the whole loss of Chromium

5th: Peroxide of Hydrogen may be formed in the Nickel & Cobalt ~~etc~~

6th

½ of the current may be used to form gas within the porous material. As this gas is meant on discharging

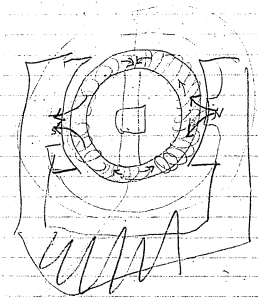
7th It is possible there is a local action between MnO_2 + the graphite, + ½ is reduced while ½ oxidized resulting in a local heating internally –

8th Iron dissolved in solution is plated over while charging - this requires amperage + it does not go back - This must be entirely too small to account for any practical loss

X

9th When Iron is reduced an impurity causes local action + undoes 1/2 that is reduced ⊙ redoes it, taking place only when current is reducing. When no current gas polarizes reduced iron + prevents further loss of charge - or standing. If this is true then the Oxalate must be got pure.

Why does Jiva Iron continue growing in KOH after taken from furnace run - it may be hydrogen but it is probably a reducing action of some impurity or an oxdyl action -



May be H_2O_2
acts as reducer

10th = If the loss was due to gassing on the iron while there is no gassing for 100 to 200 Mah on Nickel the pot on discharg there was 50% loss of amperage. This can be explained that the 50% loss is by Iron gassing because the iron is good for 1200 Mah after Nickel goes to .75 V. This looks as if it was in the Nickel & that the very sensitive NiO_2 was continuously reduced while being charged by either organic matter, or ether means. If so what is perhaps there is an impurity in the nickel that reduces it or the acid radical in solution decomposes NiO_2 to NiO as fast or rather ½ as fast as formed. Acid decomposes Ni_2O_3 to NiO always. In this case the

Radicals would reduce to NiO + give free O, or radicals would reduce the Ni_2O_3 not yet NiO_2 - + thus require more C to bring it back to Ni_2O_3 so it could be revived —

It is possible that there are still some salts in Ni giving residuals. There is certainly 1½% of Cobalt + some platinum platinum forms platinates, so in alkali + also Cobalt, both act as acid residuals. It looks very much as if the trouble was in the Nickel —

possibly NiO_2 is combined with K acting as an acid —

11 One thing seems to be certain + that is if there is a voltage of 160 across the cell + 100 ma during charge + 1000 mah goes in under these conditions, The discharge

of cell will represent a certain amount & the balance can only be accounted for by
1st gas
2nd Heating of cell & in no other way

12. If a 1200 Iron fully charged is placed with a Nickel discharged then on charging for say 200 Mah with 100 ma flooding - The Nickel will receive that amount of charge the energy loss will be large on the iron but not on the Nickel now on discharge we should get 200 Mah because the iron has great capacity yet we only get 100 Mah back. Therefore it is almost certain that the trouble lies with the Nickel where is it - or in the solution within or around the Nickel either in chg or dischg

My impression is that it has something to do with Colloidal nature of $Ni_2O_3H_2$ I think Black Ni_2O_3 would be better than the green oxide for orientation & it possibly may give more uniformity for grain & less swell — CO_2 have never tried it, with 100 Rollings & H_2 = also the thickness of the grid may have something to do with it =

B = Since a nickel charged odd way with platina as one for years 750 to Volt & 900 to 30 & yrs same nickel only gives about 375 @ 400 to Volt when placed close to an iron possibly the free H from ionizing of Iron reduces the outside layers of Ni_2O_3 at holes continuously & thus a large amount of charge wasted — be lost This can be proved by changing them apart & running them alone. Longitudinal or edge charge as free H would not only take from it but effect the plate

In our little tests we stopped at .75 V
I noticed as the total charge increased
the voltage ran down more gradual
perhaps. If we had run further down
would have shown better results.

14 = It may have something to do
with the guessing needs I am
almost convinced that a good
part of the worthy of a Ni grid
is due to formation of a + its
inability to get out through the
viscous hydrate KOH + and when the
NiO_2H_2 is previously at the KOH
+ Fe$_2$O$_3$ produced out = when mixed
in grid - swell is reduced to practically
15 = It may be a concentration problem
in charging all KOH is thrown out
of the Ni grid = Later looks this way

Ni_2O_3 40.67% of Ox

NiO 54.23% " Ext

13.56% of O Capacity

Fe to Fe_2O 14.28% Ox

Fe to Fe_2O should give 7 amphours for 7 gramme Cake

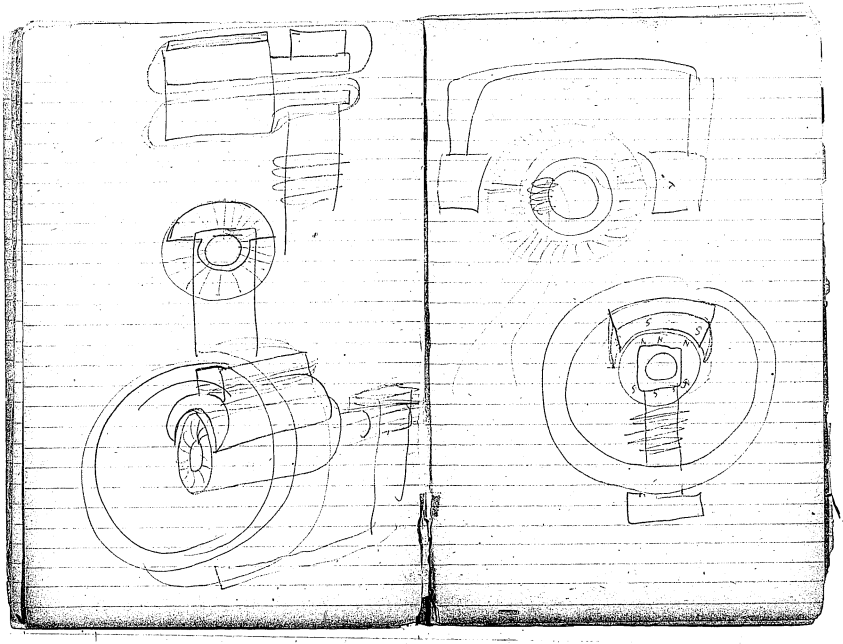
of 3500 amphours for 7 gram Cake if at 4020 to Fe_2O.

No grafite

A 7 gram Nickel Cake should give from Ni_2O_3 to NiO_2

about 3000 mahours

Ext No graf Ni_2O_3 anhydrous


S
N
N
S
S
S
R

25

24

1 coll 3.76
3.4
25

250 — 2 "
3

125

59
446 | 200
1784
216 | 4

4.4

475 — 6000
1900
950
100 —

83 | 200
66
17
9.6

25 | 1500
10
250
45

5

60 160 —

17.

51

24 | 900
16 | 350
8 | 550
4 | 0 | 6
4 | 0 | 6

51
306

6000

24 | 900
14 | 350
9
1 | 0 | 0
7 | 3 | 4

500
1500
1350
150

Weight of Sealed cell top + bottom 18 oz

Each 4.3 cake Nickel plate 180 grams
Grid alone 40
Cupsaline 40
Iron plates of gram Cake plate complete 250 gms
Water absorbed in each plate 25% 30 grms
Liquid per plate
Space for each plate 160/1000
Space between 40/1000 after swell
3" cell 18 plates,
3 Cube inches liquid to plate (h.p.)
Each Ni plate ~~[illegible]~~ 144 hours to Volt,
" Fe 28.8 " " "

~~50~~ Ni plates per HPH —
~~25~~ Fe "

Ni plates 20.3
Fe " 14
4 cells — 4.5
Water absorbed 5
Liquid KOH — 10
53.8

11½ lbs of Ni grid matter 7 lbs metallic Ni

50 Ni 4.5 — 9250 grms } 43.10
50 Fe 5 — 10.000
5 20 plate cells 7½ lbs — 7.50
Carnelian 3 lbs — 3.00
50 Ni plate above 4300 grms
50 Fe " 4000 — } 18.60
2.75 lbs — 24 13.75
650 to vault 85.9

20) 100.00 (5
86 lb
57 lbs Nickel hour
185
50
925

100. lb —
3.8) 140 (37.
114
26
45
360
44
120
72
48
166
3.8) 620 (
55
9
1
2.75
37.3
54.00
55.
4.31
163.
141
80
146
134
46
166
860
55
5
50
100
5
4.45) 192.50
141
142
133
9
1.68
21
60
746
44
46
46
44
2
1.861
276
276
55
7
1
29) 7
1.31
55 mark
12
9
1
2.86
24
124
140
20
1
86
173
30
143
37
166
120
46
74
2) 31
159
166
3.8
190
120
70
2) 31
159

Cheapest French auto battery (Heinz.)

44 Cells Costs in factory 900 francs or $11 per hph 20 amp discharge 140 ampere hours. Sell To Consumers 1250 to 1400 mean of which is $16. per hph 1st Renewal P plate at 150 full discharges $56. 2nd renewal 11 second $56 - at the end the plates are gone — Total 450 discharges Cost to Customer after 1st renewal $19.40 phh 2nd renewal $22.80. phh or 83 cents per charge — no salvage =

255. 1½ years 450 disch 22.80 per hph $16. HP hour —

512
255
257

280
44
120
120
1120
1120
123
88
35
32
3

280 Watts

280 watts

12320
1120
1120

44-watt hour
1 cell.

1400
280

16.

392 | 12320
16 | 392
32
64
0

12320
746
8960
4480
4

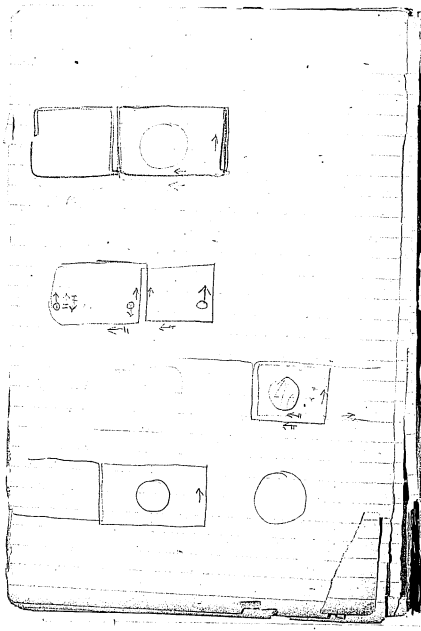
150 450-dwellings

100—

530
24
2120
1060
12720

1272
20
2544
1272
15.264

2/15.26
763.



156 lb Liquid

47.2

69 lb – 6 212
4.5
40
681.7

180,000
3000

445) 21000 (47.2
17800
3215
3115
100

69 lb per Hp Hour
430 for 7Li to 75 V
413 grms Each Grp

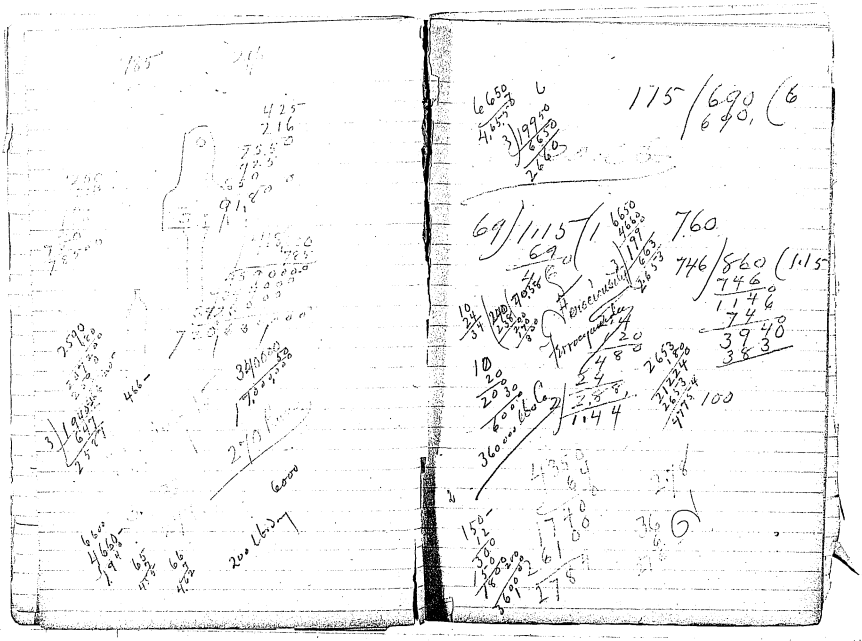
3) 1225
408

16) 1633 (102
16
33

1633

1733
128
3470
1335
2080
2075
1000
1000
1000

156



12 | 8800 | 733 ft long

24.00

733
150
3665
733
109.95

55
40
220
4
150

3 12

50 | 144 | 34
50
144
98
44
50
50
50

157.00
47

733
34
2
293
9
2 197
2 4972

2 | 733
366

350
400
75
100
4
15

35 | 30
10

10,000.00 - 100/1000 Cubes
Contract

10000 - Surfacing 60 000 —

50 50/1000 Cubes 15000 Surfacing

25/1000 " 3750 Surfacing

20 — 60-000

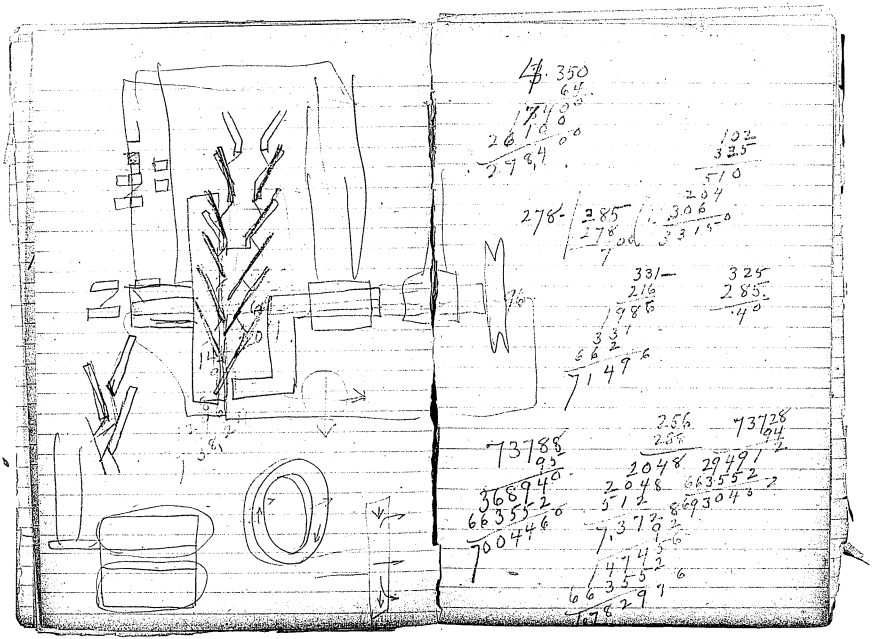
8- 150 80
20
250

80- 3

3 | 300

9 ft hard Cubes 50/1000 — Surfacing 15000
25/1000 30 000
12½/1000 60 000
6.25/1000 120 000

10/1000 —



5 9000

72000,

14400

7200

864000

256

32

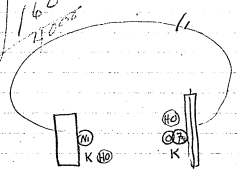
14400 water

960

240

850

720 630 000



K_2O HHO

K_1

$-O-H_2O$

200 000, share

140000

100 000

14,000

10,000

40 dollars – invested
5 yrs at 4 20 –
Leases 20. finally invested
at 1 share, pay 8 percent
or 4 on 20. 20% on the money

45 – back 20 leaving Cost
25 4. years 16% on money
50 20 back Cost 30.
4 reed 12% on money

1% on Com –

		1%	2
5	50c year	10%	20
6	50 "	8.4	16.8
7	50	7.2	14.4
8	50	6.25	12.58

550 – 5

450

650

Pref 5 yrs Cost 40. 20% on money
45 16%
50 12%

	1%	2%	3	4
Com 5	10% on money	200	30	40 0
6	8.4	16.8	25.2	33.6
7	7.2	14.4	21.6	28.8
8	6.25	12.5	18.75	25.0
9	5.5	11.0	16.5	22.0

New Cap – 12000000 Com
3000000 Pfd 240000
1.500000 bnds – 90000
3 300000 fixed

45 cbbl – Sold 70 Capacity 8000 day 325 days
Recpts 600000 –
330000
820000 – surplus –

2% on 12 million 220,

Have leaving 100000 surplus 2% on
stock – 16.8% on Com at 6.

5 | 30 000 000
146 000 000
16 000 000
7

5000
400
20 000 000
400
3 | 1100
300 000
146
176
146
263
7000

263
30
5
1315
1841
1975

349 000
170 000
6000
2000

6840
4.1848
4900
4.1848
11

49
49
245
245
245
245
4844
3
4842
4842
210

11

20 m

900 000 000
4000 000 000
8000 000 000
2 | 1200 000 000
1200 000
6000 000

65

718
60
450
4308
300
65
500
1800
718
65
1800
1795
559
4308
975
4867
975
1385
146
1461

30
3000
30000
146
10000
30000
50000

750 –

4 bushels – 30

$12

720 –

3|4220
407
57
32 | 1660

1810
120
690
360
180
90
45
2.25 3 | 1160
387
1547
108.5
49.5
14.5
59.5
38.5
4

3|1120
373
149.3

1627
0
694
33
181

3|100
33

3|1110
370
148

39
9
17

30 plates

90
300

600.

Nolan processes

Extracting for Cu ores by lead
~~ore~~ not now done – large slag ag →
cost process used – ~~[illegible]~~

Supposition furnace 11 tons lead
Ag ores added when letting common
form – 50 to 100 lbs ore that has
been used – the impure litharge
raked off – ore blende & copper
ore Ulmann ore – ore fcontes, pretty
rents As + S if present ore puts at
Eliminated Ag is reduced by the Pb
fraguently that PbO – any residue
on top with fluxed by the PbO
when slag flux, raked off & supposition
proceeds by adding wood as
Cinder place 2 day 1/2 hours
1/2 ton is added to bath having
11 tons lead

The Chief Ferro used to hand fume removed
ores preparatory for something [illegible]

Ag Sulphide — not completely
decomposed by Lead nodules

Copper dissolved by H_2SO_4 is nic — Cu granulated
H_2SO_4 passed over it, solution left upon
[illegible] (warm)
water filtered (warm)
Ofts Co Ni dis Pb undissolved
Sb Sn Bi form basic salts remain
principally in residue Ho
quality goes into Sol as As_2O_3
" chiefly remains as insol
! Arsenates — Antimonates
& Arsenates are decomp
by warm H_2SO_4 forming
Antimonic & Arsenic acids
CuS also Au Ag remain in
residue —
Tower used, lined with Pb —
false bot, air Enters bottom
wet top, steam used
heat liquid

Every hour or ½
Long trough used 360 ft long for 8 hrs.
at end trough Pb dissolved & antimonic
& [illegible] formed
most dry formed imp'd at 1st end trough
with Bi yields $CuSO_4$

Careful roasting will permit $CuSO_4$
& $FeSO_4$ to be formed & by careful
roasting leight the whole a / $FeSO_4$
decomposed which more dry
$CuSO_4$ decomposed The Fe_2
decomposed oxidized SO_3 & not SO_2

With a mixt of CuO & Fe_2O_3 —
3% Sol. of H_2SO_4 will dis the —
Cu but no more steam & [illegible]
to heat not density required
exceed 26 B otherwise gypsum
get choked with [illegible]
Residue has all the Ag Au Pb
[illegible] Co Ni As
Sb Bi & $CuSO_4$ any Ag that may
have gone into sol is reduced
by $FeSO_4$ to metal

1

Augustin process
AgCl in ammonia chloride chloride solution
roasting with salt & dehydration
75.504 — the AgCl is dissolved out by Sol Common Salt the
ag. ammonia precipitated by
NH4Cl + Co2O3
100 pts Sol. Salt dissolve 1 lb 20 ounces up
0.4 AgCl (or another more strong
1 litre Saturated Sol Nacl dissolves
0.195 gram AgCl at ord temp
or 1.27 gram at 196 Cent
Solubility of AgCl in Nacl is far less than
in CaCl2 by AgCl. Augustin process
not now used
If gold present can AgCl be dissolved
with Na or Ca Thiosulphate is best
to separate the au —
Vats used fabric lost
Arsenic & antimony ag are unsuitable
dis & give rise to alg. based
one condition necessary in Augustin
process Sb or arsenic Sb 9Pb
except in small quantities.

Pilera process
Ore roasted (chloridizing)
AgCl dissolved by ~~Na Thiosulphate~~ Na
Thiosulphate Ag precipitated
adding Na Sulphide — precipitated by Cu
not feasible as Na Thiosulphate sol
dissolves AgS as well as Cu2S
insol compounds of Na Sulphide are
precipitated which regenerates the
Na Thiosulphate —
Solvent power for AgCl of Thiosulphate
is 100 times greater than that of
100 pts Thio dissolve 40 pts AgCl —
Ca Thio dissolves about as much as Na Thio
91 to 100 —
Thio decomposes the AgCl forms
Dom Sulf. Na Ag Thiosulphate
Pelera process crushed roasted not as
fresh in Pb Cu or CaCl2
Ca gives Caustic in roasting & reduces
AgCl to Ag & dumps sol of most
insol Compounds in Thio —
Tendency of Ag to form
Sol Dom Salts & that precipitate
lead as hydrate & thus carries
particles of gel with insol chem

Practical application —

Impurities which become insoluble of Pb & Cu precipitated by selectively soluble sulfides by leaching water before running Thio

Pb may be precipitated as Carbonate

used in Thio by using Na_2CO_3

Cu particularly important if ores with Pb because they is difficult to separate from precipitate Carbonate Pb + Cu Sulfides. Then fully Cu + Ag Sulfides precipitate —

Sb + As do not act injuriously as it does in Amalgamation process because Arsenic & Antimonide of Ag give up free ions which combine to Thiosulfate Salts

Any insoluble silver present or formed during roast is also dis by Thio solution though unknown need Ag Sulfide or its compounds with As or Sb Sulfides do not all dissolve by Thiosulfate —

Rarely Thio solution used to dis AgCl already existing in ores but generally used on ores containing impurities or compound sulfides of Ag which have been chlorodized to avoid

This process not used for exclusively Ag from the leaching products

(Ag_2AsO_4) dissolves in warm Sulfite solution 0.2 part Ag for 1 part crystalized Na_2Thio — Ag Antimonite requires 1 part Thio for 0.05 of silver.

Solubility of Arsenates & Antimonates is considerably increased by presence of NaOH in solution!

$CuCO_3$ is sol. Pb Fs - Mn Zn Ag Carbonates insol in Thio. Cupram (OH_2) is sol but Cupric OH & Cu O are OH_2 + hydrates Fe Mn + Zn not sol —

Cupric Cl dis with formation of double salt. Pb SO_4 dis to double salt CT

Calcium SO_4 dis forms Na_2SO_4 + $NaCaThio$

Caustic lime — sol in NaOH + $NaCaThio$ produced the sol in Thio forms CaS_2O_3 — H_2O

117

936 000

24) 2808000 (117000

2 5 3. 1 gram

36 — 36 grams per liter

312) 12000

1000

312000) 12000000 (.38

2640000

120000) 312000

15 3) 100000 (14 74.60

20

148

Solubility of Ag&Cl in Thio demonstrated
by precipitation Pb + Na Sulfide
+ particularly by Cornish & Clark
Clark & Cornish patents —

Kiss process
Thio used, process same as
Patera — the Ag ppt. by precipitating by
Calcium Sulfide Calcium Thiosulfate
being regenerated —

Russell process
Ag present in ore as sulphide
or in combination with As or Sb sulfides
or as amalgamate or cyanide
or in metallic state with gold
is dissolved by Sodium Copper Thiosulfate
Ag precipitated by NaSulfide —
in Russell process used as complexing to
Patera — Solution 1st by Na Thio,
then follows with "Na Cu Thio"
the latter solvent dissolves gold, Ag, metallic
Sulf. or any sulfide amalgamate or
cyanide of Ag by replacing this

to prepare NaCuThio — $\frac{1}{4}$ pt by wt of
NaThio 1 pt. CuSO4 added to water —
Decomp by air. make as wanted.
Russell's sol'n this real active Ag
at and below 9 times + at 50°C 3½
times quicker than NaThio
Reason of increased solvent power due to
Cu Sol'n absorbs O from the air nothing as
a carrier of O.
McCallin & Gill in this about same as
with Reg Thio Na
Ag Sulfide rapidly decomp by Double
Salt CuS by precip + Ag ppt. sol
(by this in crude Cu)

Claudet process
precipitation of Ag from liquors by
Zn & Pb — if lead present Pb Zn & Cu
come down —

Gibbs process for precipitating Ag in solution –
Uses H_2S & stops after 6% of the Copper has been precipitated – so all the Ag will be precipitated by this time – being roasted, Cu partly converted to $CuSO_4$ + part oxide – while Ag converted chiefly to Chloride by action of Chlorine remaining behind in precipitate roasted ferrous ground & treated in Vats 1st with H_2O then hot NaCl, which dissolves Sal treated milk form – whereby all Ag is heavy insoluble precip
for precip Cu dissolve H_2SO_4 & decomp residue – Continue till all the Ag off –

Duclos proposed to leave ferrous & dissolved iron thus the Sal ammoniac & proportionately smaller amount Cu precipitate – Cont

Cut to here

Ziervogels process

Converts Ag by roasting into Sulphate, when Cu Fe sulphates present, very careful roast, $AgSO_4$ Sal H_2O + precipitating Metal Copper –

Careful roast of Cu Matte containing not too great amt FeS Ferric Sulphate 1st formed in addition to Fe & Cu Oxides – as temp raised, the Sulphates Fe decomposed SO_3 evolved this + O of air bring abt formation $CuSO_4$ The latter Sulf being elimd at temp that yields SO_4 decomposing temp $CuSO_4$ decomp to $CuO + SO_3$ – or $SO_2 + O$ – SO_3 act by converting the hitherto undecomposed Ag2S into Sulphate, SO_2 + O being produced the O yielding powerful oxidizing action on the $AgSO_4$ $AgSO_4$ is effected at temp where $CuSO_4$ decomposes – careful result – $AgSO_4$ & oxides Fe + Cu

If temp too high Ag Sol decomp

If As or Sb present arsenic or antimonide of Ag formed on treating these by ammonical H_2O according have Ag if Bi present it forms metal dissolved sulfate the which silver sulfate Bi.

Pb or Sb sulfate.

Process sulphuric dissolves separation & electrolysis precipitate separation

Hence of Cu process depends on separation of As Pb Bi Sb compounds

1 pt Ag Sol dis in 180 pt. H_2O.
" 88 boiling H_2O
180 H_2SO_4 110 B and boil
30 " boiling 10 B.
20 " 20 B boiling
4 " Cold H_2SO_4 60 B
0.25 boiling H_2SO_4 66 B

If Cu prime or present in result are precipitated on dis in H_2O must be resolved so Cu precip —

~~Ag~~ Raw ores never worked by this process reason in Spain Ag precipitated by granulated Cu & put in Terrible Vats.

Cyanide process

Ag or Ag Cl sol in KCy & precipitated by Zn Pb or HCl,
0.5% sol. 10 hours, then same strength sol 5 days then 1/2 strength for which —
HCl precip Au as $AuCy$
the weaker the sol the more Au dissolves

Amalgamation process

AgCl easily decomposed by Hg from
Mercurous Chloride Ag which is
with Hg — AgS slowly decomposed by
Hg forming HgS more rapidly in
presence of Fe or other base
As + Sb compounds of Ag are only
slowly & incompletely dec by
Hg alone,
Decomp of AgCl by Hg marks loss of
Hg from HgCl — best use metallic
Fe to decompose in presence of Hg then
amalg Hg —
AgS ores are best treated with incorporation
Fe + Hg or CuCl + Hg either alone
or together with Iron Cu Pb or Zn
or else Ag ore Chlorinated roasted &
then treated Fe or Cu + Hg
If ores contain As + Sb CuCl + Hg used
or CuCl together with Fe Cu Pb Zn
+ Hg — or Hg roasted Chloridizing
treated with Fe or Cu in presence
Hg — Clay or Magnesian silicates
in ores bad Coat mechanically

Gold more easy to amalgamate Zn Pb + Bi
also amalgamate —
As + Sb only amalg with difficulty
Fe Co Ni not at all —

Amalgam in presence of Fe or pyrites
but without previous chlorid
roast,
used where Ag exists in form
Sulphide arsenic or Sb compounds
or simple sulphide or form of
simple haloid salts —
Rich ores, being coarsed — amalgam
& separation —

Krohnke process amalgam

Hot Sol Cupreous Chl in Common Salt
to decomp Ag compounds which
are then reduced by Zn Pb used
in form of iron cement pan —
The S As + Sb compounds are reduced
electrolytically. Sn + Cu are best for
reduction Fe Pb + Sn more feeble
silver recovered by use powdered
Zn or electrolytically —

991	1088	97	1088	1109	21		
953	1037	84	1035	1072	37		
970	1050	120	1075	1086	11		
974	1084	109	1090	1097	3		
931	1037	106	1026	1046	20		
964	1065		1063	1082			
959	1041		1047	1058			
961	1053		1057	1070			

3)1080 — 360 — 144

1440 — 800 — 1750 — 144 — 2.97 88

805 — 37 — 68 — 35

27000 — 340 — 110000 — 8500 — 9.14 — 9

125 — 37 — 88 — 352

260 — 125 — 130 — 26 — 3.33 — 40

9000 — 9

8100 — 340 — 32400 — 2430 — 2.716 — 2.536 — 2.477 — 310 — 1.94

12 Million

390000 — 145 — 23 — 130 — 430 — 290 — 3.33

725 — 146 — 65.50 — 4.93 — 3.70

266 — 3.33 — 730 — 9.41

17% — 1900 — 1600 — 1,300

12 — 400 — 1200

12 — 2600000 — 390

12 — 1.97

65 — 140 — 600 — 74 — 21 — 8.16 — 8.16 — 4.46

2.106 — 120

8.40

3)1080 — 360 — 144

1440 — 800 — 1750 — 144 — 2.97 88

805 — 37 — 68 — 35

27000 — 340 — 110000 — 8500 — 9.14 — 9

125 — 37 — 88 — 352

260 — 125 — 130 — 26 — 3.33 — 40

9000 — 9

8100 — 340 — 32400 — 2430 — 2.716 — 2.536 — 2.477 — 310 — 1.94

12 Million

390000 — 145 — 23 — 130 — 430 — 290 — 3.33

725 — 146 — 65.50 — 4.93 — 3.70

266 — 3.33 — 730 — 9.41

17% — 1900 — 1600 — 1,300

12 — 400 — 1200

12 — 2600000 — 390

12 — 1.97

65 — 140 — 600 — 74 — 21 — 8.16 — 8.16 — 4.46

2.106 — 120

8.40

991 — 1088 97 — 1088 — 1109 21

953 — 1037 84 — 1035 — 1072 37

970 — 1050 120 — 1075 — 1086 11

974 — 1084 109 — 1090 — 1097 3

931 — 1037 106 — 1026 — 1046 20

964 — 1065 — 1063 — 1082

959 — 1041 — 1047 — 1058

961 — 1053 — 1057 — 1070

3)3292 — 097 — 5)4819 — 964 — 5)5326 — 1063 — 2)2112 — 1055 — 2)2141 — 1070 — 5)5314 — 1063

3)2910 — 970 — 3)3240 — 1080

3)2974 — 991 — 3)3110 — 1037

123 — 961 — 1.16 Cu 504 — 5410 — 1082

400 lb. water

94 — 931 — 26

3)3328 — 1109 — 3)3216 — 1072

3)2265 — 1088 — 3)2108 — 1053 — 500 — 4000 — 250

3)3079 — 1026

2000000 — 16000 — 4 — 3)3259 — 1086

3)2259 — 953 — 64 — 8000 — 1000 — 125

3)3225 — 1075

3)3102 — 1034

3)3112 — 1037

3)3137 — 1046

3)3225 — 1084 — 3)3271 — 1090

3)2923 — 974

[illegible] is considered for the precipitate.

Cuprous Chl should be prepared when used as it oxidizes quickly to Cupric Chl & oxychl.

Preparing by using 1 pt $CuSO_4$ dis in 6 to 20 pts of Conc NaCl or H_2SO_4 to [illegible] of 0.5 to 1% of the $CuSO_4$ used as for the Sol.

Abstracting in to add NaCl to 2 oz $CuSO_4$ of 50°B so long as the dis Cupric Chl & Na_2SO_4 formed. Liquid boiled by steam & heat. Copper used reduces the Cupric to Cuprous. The free SO_4 precipitates from brines. The Cuprous Chl though slightly oxd H_2O is insoluble, but in NaCl.

Sol ok as long as decolorized.

Zn amalgam 1 Zn 10 Hg heated together then excess Hg squeezed out.

Barrels used - rolled, pitch pine 3" thick now being served to break up the dry - lined to prevent removal of Hg.

Vessels must be used free from reduced Cu & Cl to Cu. Wood rods used to break up ore.

~~Solution~~

One Con Sol to 3 times ore. Strength sol 8% + salt used in 3% of wt of the ore.

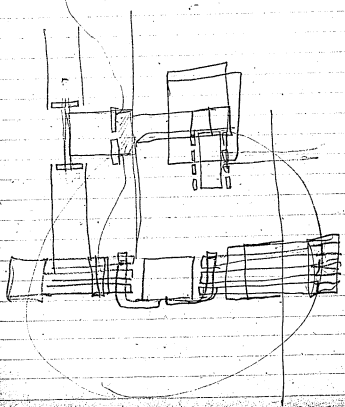
3 times ore requires 600 lbs Hg. Care taken that at end operation. Excess Cuprous Chl to prevent after mixing - Vessel filled could be [illegible] allowed stand some time & then readded to 1 to 2 hours. Then water scattered Hg.

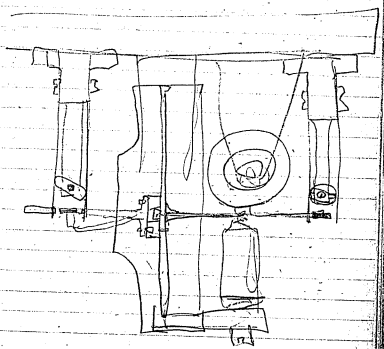
Amalgam Coal mine Cu & Chl.

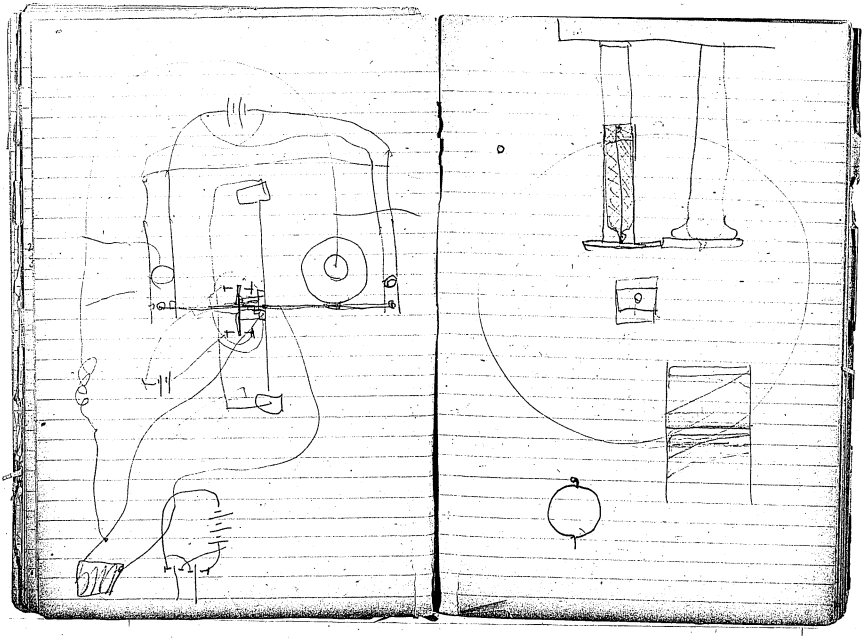
Amalgamation of Silver ore. High [illegible] NaCl & thermo, sulph roast. High [illegible] reduced. Ag converted into AgCl & As + Sb compounds. Silver also converted into AgCl. Then SO_4 evaporated the residue by [illegible] off SO_3 leaved HCl & Cl for the NaCl - The ferric chloride in dissolving the Ag

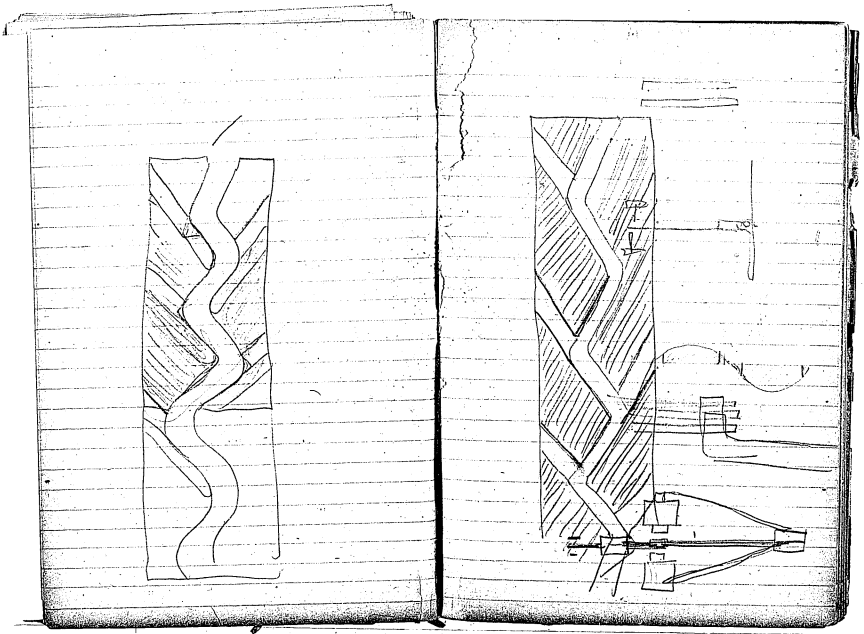
400 lbs rosin dissolved in 8% NaOH &
2% dehydrated Tapioca Bulk Gum

Reese River Pan process
Chldg round.
pans with wood sides
Millers.









64
320
70

3/4

16
64

160
80

1:2

40

16) 100 (6

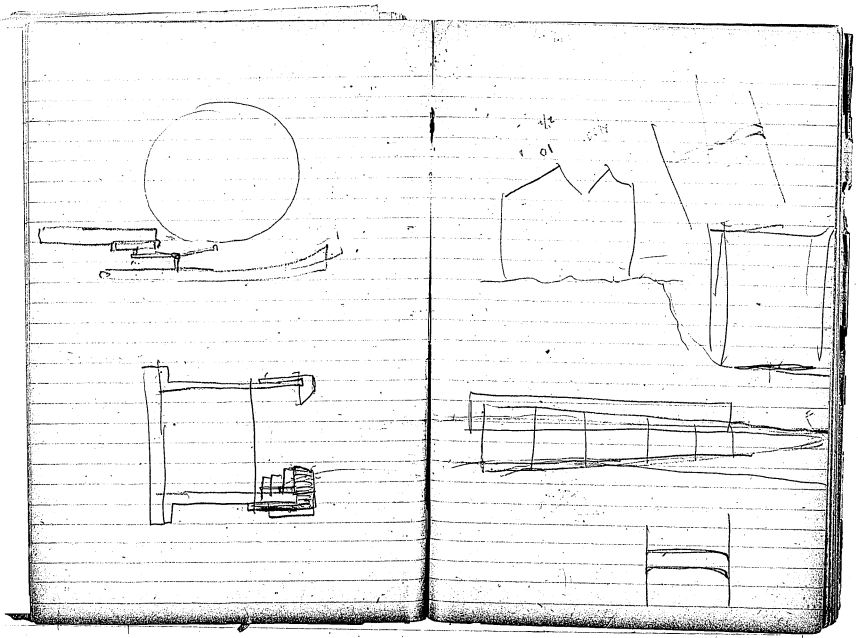
8 10
16 5
32 2 1/2
64
5 1 1/4
10 .6
20 3
40 1 1/2

2175

714 66%
357
4 378
476 1175

80 % 20 5% 40

4166 5 416 25 2175
1320 45
1316 3 75
1335
1200 84
95% 16 4200
1300

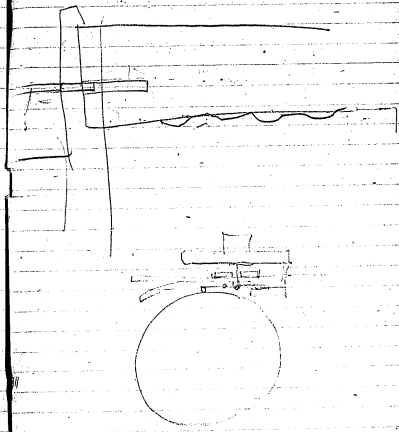


2000 —

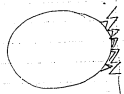
57

57 —
2
114 —
20
2284
4 | 9120 | 190
12 | 2280
20
108

190
450
950
760
950
855
2565



003— 1800 Each



108 gram per 1000

324	003	.72	lb
432	004	.96	
540	005	1.46	
648	006	1.46	

005 540

446 | 3240 | 72
31 22
116

446 | 4320 | 96
4014
3062
22

4320
108
35
1296
1296
-96
3

3 | 1350
450
3 | 225
75
3
0

180
180
0

180 | 144
180
324

180
9000
0000
-54
004

446 | 5400 | 121
446
9 48
7200
4

1320
420
80

446 | 6480 | 145
4460
2024
1784
2360
222

003— .72 lb
004 .96
005 1.21 1/2 lb more
006 1.45 .73 lb more

1.21
.72
.49

1.45
.72
.73

1.21
.74
1.95

210
144

2.80 | 446
1.44
920
920
2.3
3.3.1
3

3310 | 74
3.22
188

N
S
N
S
N
S

269	250	62500	275	4125	15	1.65	mult for 6	1413	4239 per plate
225	200	40000	225		18.2	1.35	" "	905	3258
221	175	30625	200		20.6	1.20	"	692	2768

1060 Gaui

442

275 250

2500
250
125
500
500
62500

2768
2249
275
15
4125

3258
2250
6

424
6
2647

175
175
875
1225
175
30625

275
15
1375
275
4125

225) 4125 (18.2
225
1875
1800
750
675

325
6
1950

200) 4125 (20.6
4000
1250

275
165
200

50

905
905
7240
905
7629

905
18
7240
905
7629

442) 40000 (90.5
3975
2200

90.5) 7629 (1060
353
1413

1413
15
7065
1413
21195
4239

1629
7
3258

905

1413) 62500 (44.2
5652
5982
3652
3528

44.2

442) 30625 (69.2
2652
4178
3978
1200

1.650

692
20
13842
27.68

225
7
1575

1413
1.5
4239
1.20

977	1139	1173	1186
1020	1175	1187	1225
983	1149	1181	1212
899	1102	1126	1127
899	1045	1064	1113
952	1122	1150	1173

5)4758 / 952

5)5610 / 1122

5)5865 / 1173

3)3344 / 1113

5)5757 / 1150

3)3135 / 1045

3)3257 / 1086

3)2697 / 899

3)3381 / 1127

3)3306 / 1102

3)3377 / 1126

3)2637 / 879

3)2930 / 977

3)3160 / 1020

3)2948 / 983

3)3525 / 1175

3)3449 / 1149

3)3417 / 1139

3)3518 / 1759

3)3559 / 1186

3)3356 / 1187

3)3636 / 1212

3)3518 / 1173

3)3542 / 1181

3)3674 / 1225

959 — 1041 1047 1058

8)7671 / 959

8)8326 / 1041

8)8375 / 1047

8)8466 / 1058

1126	1269	1291	1159
1104	1234	1254	1155
1085	1242	1296	1124
1021	1223	1270	1228
~~958~~	~~1054~~	~~1053~~	~~1062~~
1084	1242	1278	1165

$4\overline{)4662}$ 1165

$4\overline{)5111}$ 1278

1070
1058
$2\overline{)2128}$
1064

$4\overline{)4336}$ 1084

$4\overline{)4968}$ 1242

Co	1084	1242	1278	1165
M	959	1041	1047	1058
	125	201	231	107

	1005	952	1122	1158	1173
024 Co	1084	1242	1278	1165	
M	961	1053	1055	1070	
	123	189	223	95	

$3\overline{)107}$
36
143
~~150~~
1440
142
254

$2\overline{)2128}$ 1064

$2\overline{)2170}$ 1085

$2\overline{)2168}$ 1084

$2\overline{)2242}$ 1121

$2\overline{)2242}$ 1121

$2\overline{)2584}$ 1242

$2\overline{)2592}$ 1296

$2\overline{)2248}$ 1124

$2\overline{)1918}$ 959

$2\overline{)2106}$ 1053

$2\overline{)2124}$ 1062

$2\overline{)2114}$ 1057

$2\overline{)2252}$ 1126

$2\overline{)2538}$ 1269

$2\overline{)2540}$ 1270

$2\overline{)2310}$ 1155

$2\overline{)2508}$ 1254

$2\overline{)2582}$ 1291

$2\overline{)2310}$ 1155

$2\overline{)2209}$ 1104

$2\overline{)2468}$ 1234

Co 1126 1269 1291 1159
1104 1234 1254 1155
1085 1242 1296 1124
1021 1223 1270 1228
~~958 1054 1053 1062~~
1084 1242 1278 1165

Co 1084 1242 1278 1165
M 959 1041 1047 1058
125 201 231 107

1005 952 1122 1158 1173
024 Co 1084 1242 1278 1165
M 961 1053 1055 1070
123 189 223 95

$3\overline{)107}$
36
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1440
142
254

$2\overline{)2128}$ 1064

$2\overline{)2170}$ 1085

$2\overline{)2168}$ 1084

$2\overline{)2242}$ 1121

$2\overline{)2242}$ 1121

$2\overline{)2584}$ 1242

$2\overline{)2592}$ 1296

$2\overline{)2248}$ 1124

$2\overline{)1918}$ 959

$2\overline{)2106}$ 1053

$2\overline{)2124}$ 1062

$2\overline{)2114}$ 1057

$2\overline{)2252}$ 1126

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$2\overline{)2310}$ 1155

$2\overline{)2209}$ 1104

$2\overline{)2468}$ 1234

Co 1126 1269 1291 1159
1104 1234 1254 1155
1085 1242 1296 1124
1021 1223 1270 1228
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Co 1084 1242 1278 1165
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$3\overline{)107}$
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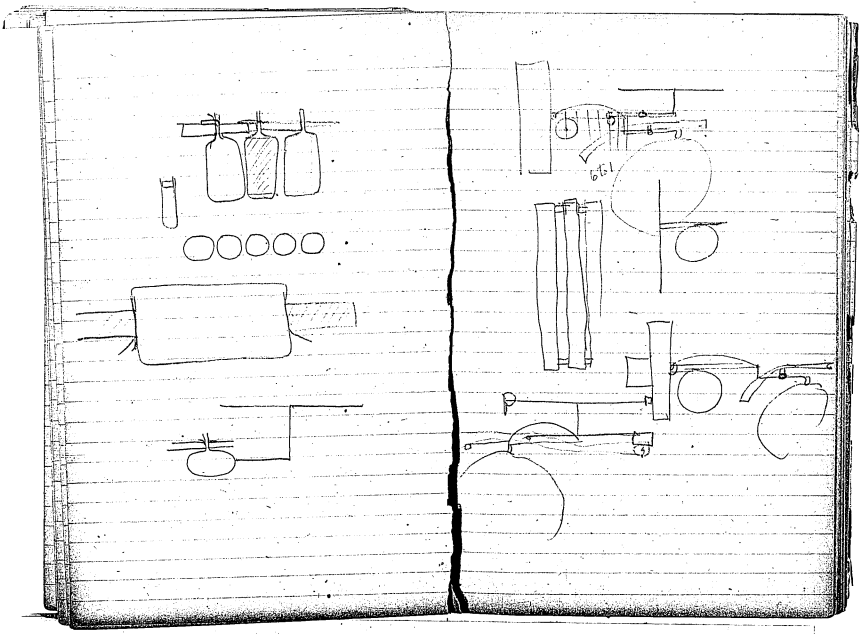
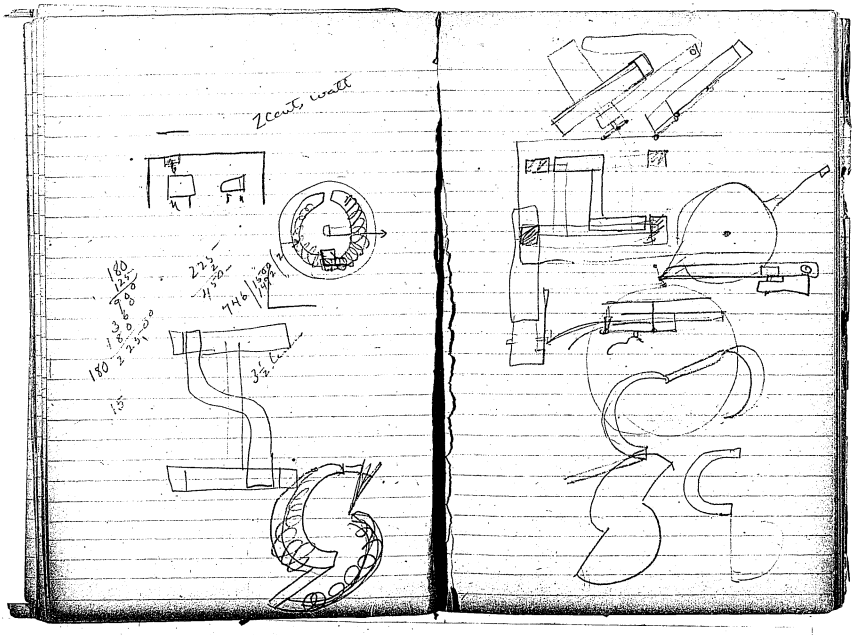



2 cent, watt
180
125
90
80
3
180
2
225
1.5
225
7.50
746
1.39
1.44
3½ ton

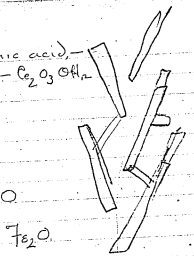
Succinic acid,—

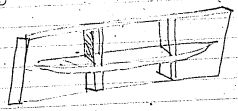
Fe_2O — $Fe_2O_3OH_2$

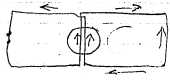
FeO

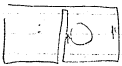
Fe_2O

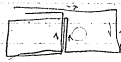
S

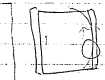


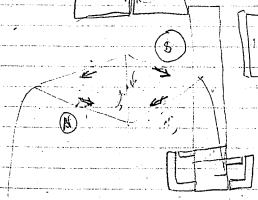


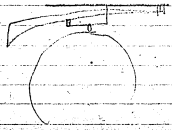








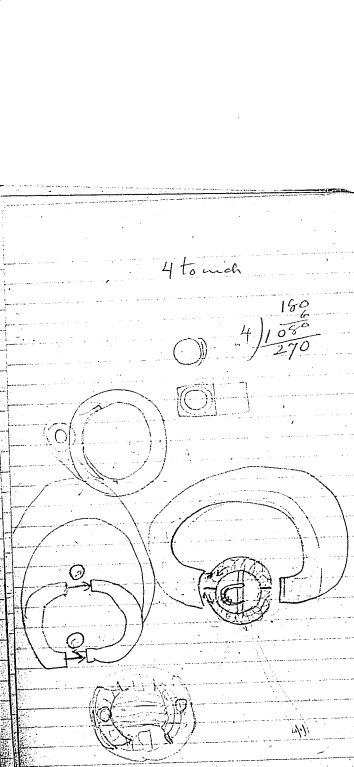




S
N

4 to much

160
6
4)1080
270



7c 77
5,89-

1.87 ft 1" thick

270
100
144)270.00
144.00
126.00
112.50
1080
198

100)1.87-
187.00
144.00
748
748
187
2692

3.5)2690(97 lb
2450
24

3600
325
7500
1000
$1,170,000
65000

1170000
216000
954000

954.000
330000
624000

120 | 6500000 (5:
600
5000
12 - 5/-

630
189000
120 | 70000 (583/3 - 14
600
18000
9000
4

$70 000 month now - 120 output.

$15 = " " " 9
12000 month bags -
270000 | 12000000 (4.4.
108000000
12000000

800.
$1000, day
90000 | 100000 (99
9000
1000

1,300,000 - 12
10/

60.
54450
3400
600
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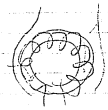
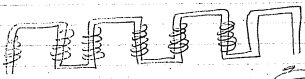
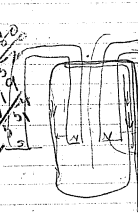
1620
18

1,8526
1,3
1,3,39
1,3,39
1,4



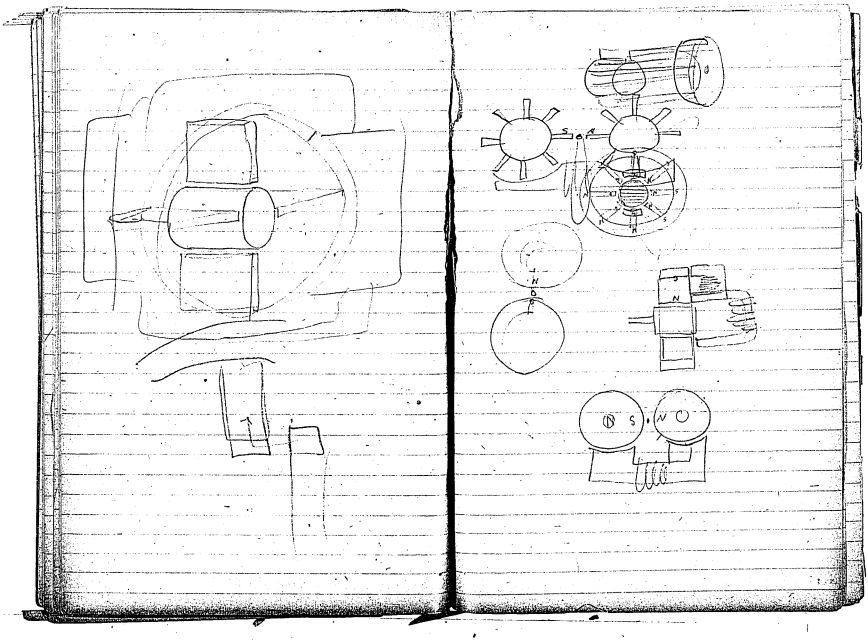


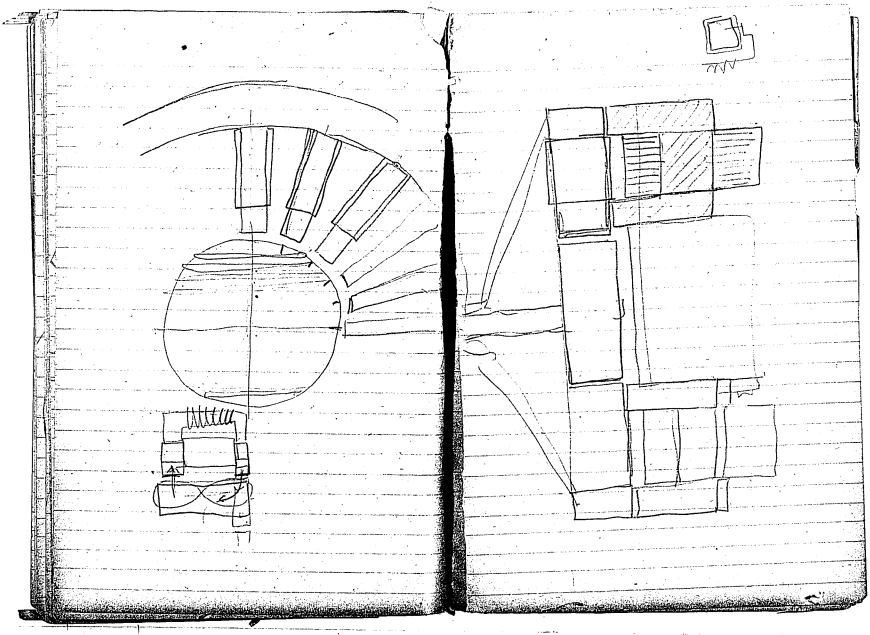
1064
353
741120



N
S
N
S
N
S
N
S

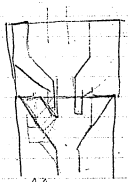
N
S
B
A
S
S


S
N
N
S



90000 inches

1728) 90000 (52
8640
360



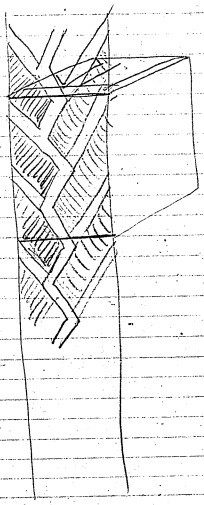
52 Cubic ft —

8 —

45
8
360
25
180
900

60
40
240

52) 2400 (46
208
322
312
10



#3 Cubic yard —

1200 ft 1"
875
2075

7 | 8400
1200

9 | 64

335
175
1935
3300
3310
3300
234

175

4 | 3500
875

4 Sand 1 Cement.

6857
26
548856
13714
19717

13
2000
240
2400
400
2800
275
25

3.5 | 6857

485
1944
3101

191
300
300
100
891

175

2134
460
2594

25 Cubic

275

100
38
3800
3800

1900 ft side —
315
2215

2500 ft

100 Cubic yd

35

210
6
4 | 126
315

8300
4200
5000
600
700

70

35

70
3

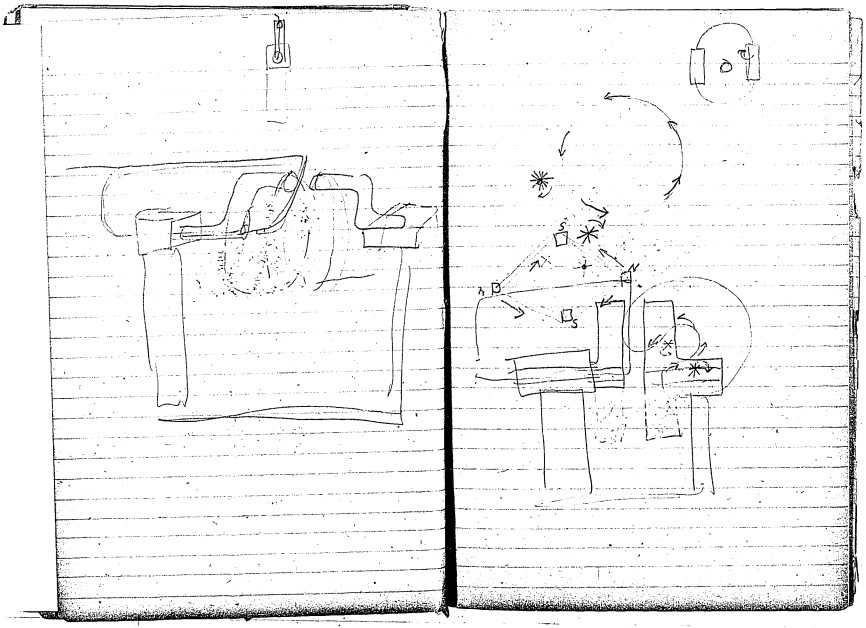
200
35
7000
6000
1000
4400
154

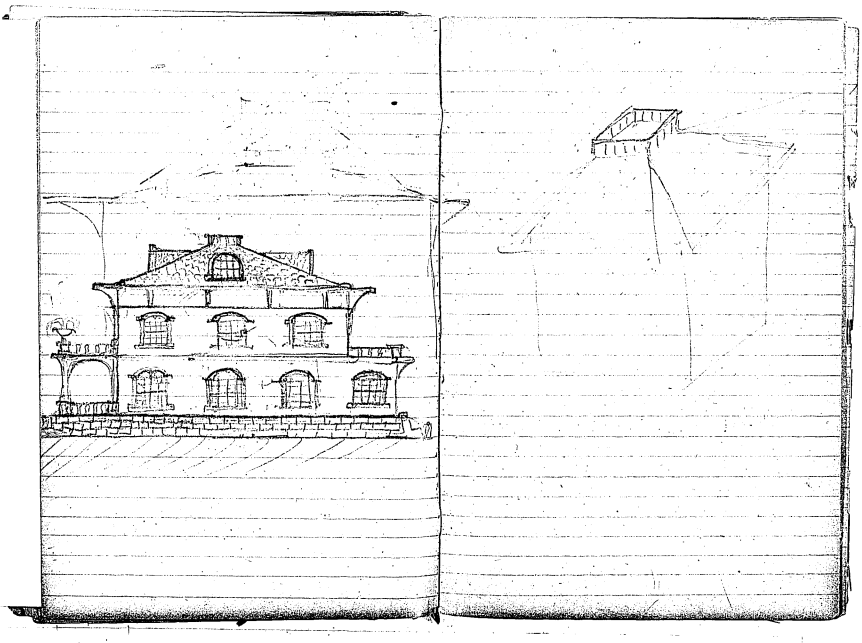
210
44

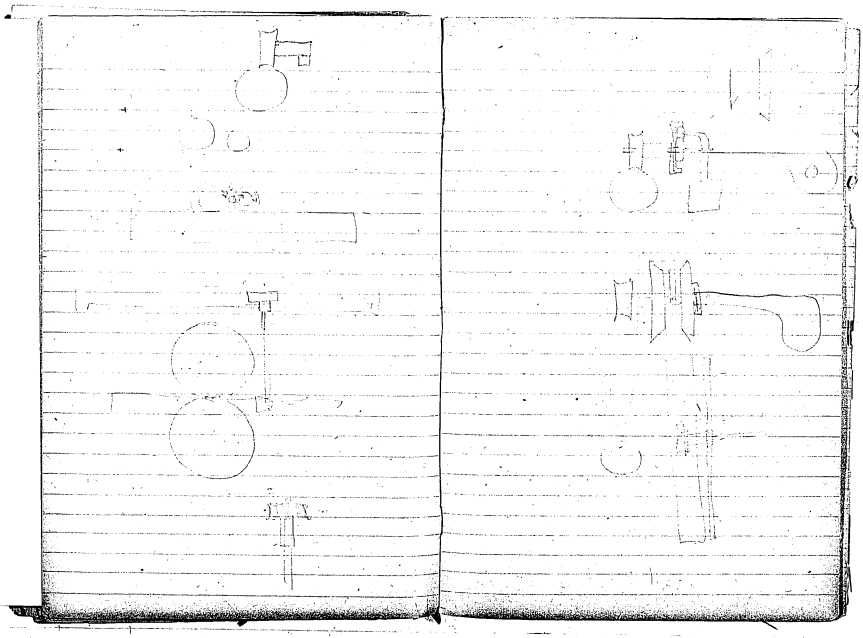
280
30
840

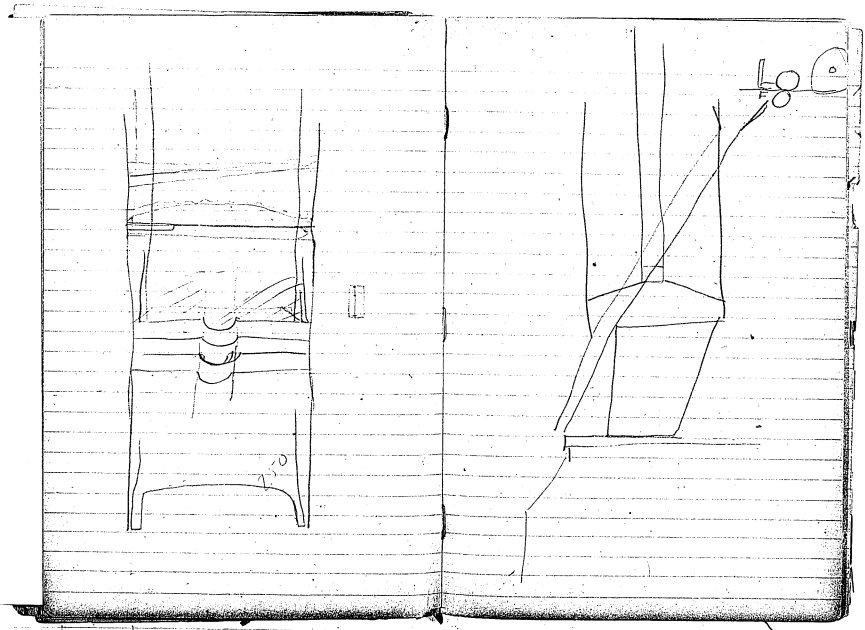
84400 3/8
3500 1/2

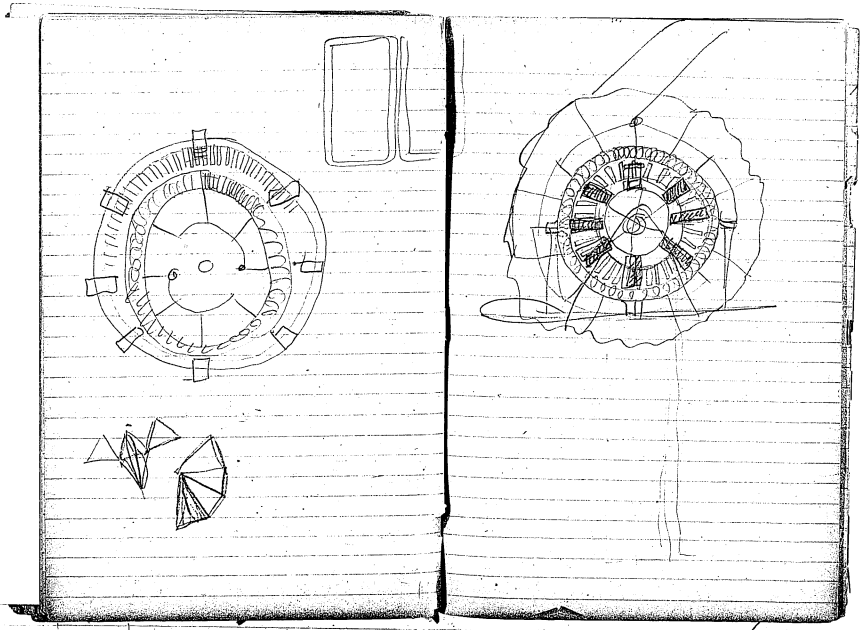
7000
3











5146 per ft

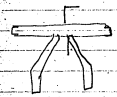
4779
140
16
191
4779
6691

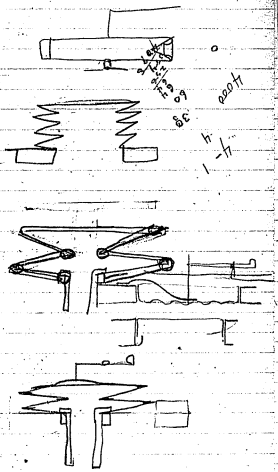
144 | 5150 | 35
432
83
3566 ft

669000

130 | 669990 | 5146
650
19
18
1300
1300
300

45
45
40
30

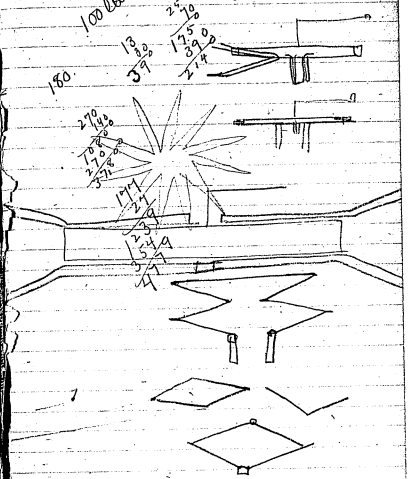


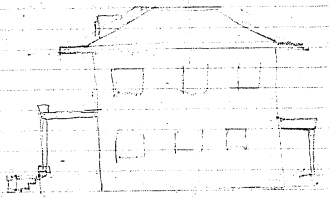


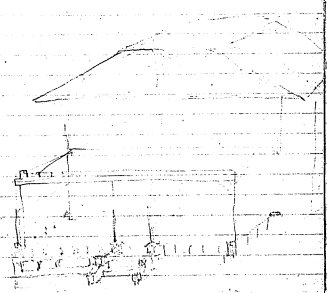
Hydrocyanic acid
Decomposed by NaOH,

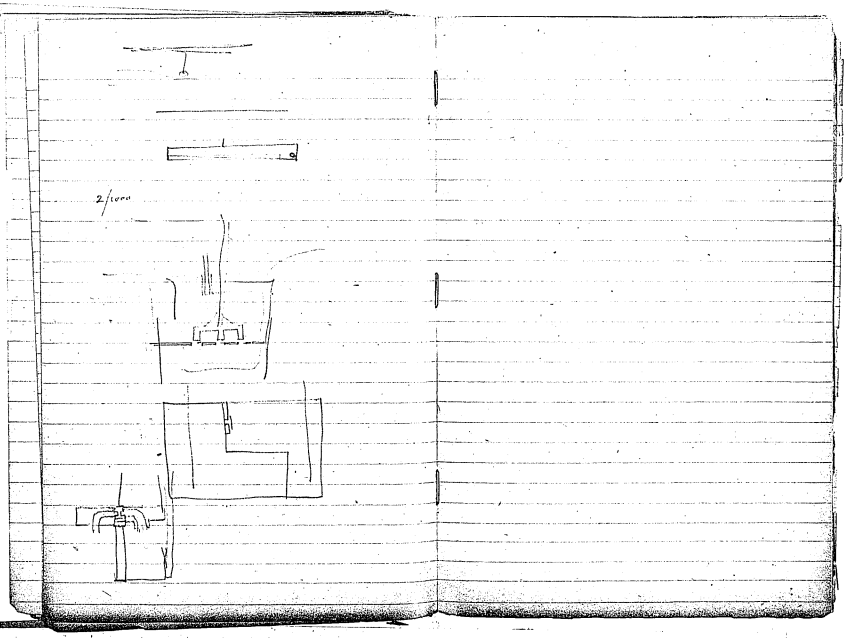
Lead by present Sulphurous acid
Nitrous O_4 – 7 filled SO_4
Nitric oxids
H_2S,
– Phosphorus
Arsenetted H, of Zinc test
the SO_4 has arsenic

Dumas uses U tube 3 ft long
broken glass 1st tube monsulfur
Nitrate Ag — then removes
H_2S — 2nd tube Sulphuric
Silver then removes
Arsenetted Hyd
then tube Lumps KOH,
then Ground phos
acid
The Sulphurous acid
should be free of
Nitrous and Oxides
Sulphate Cop absorbs Arsenetted Hy
" " phosphyd








2/1000

43
67
11

1254

170 | 740 (4.03
680
2600

850
30
2550

3

255

67

170 | 1254
1020
1940
1700
2400
2380
20

850

11

340
33
14
140
1254

850

850

510
230
740

9mm

7

55

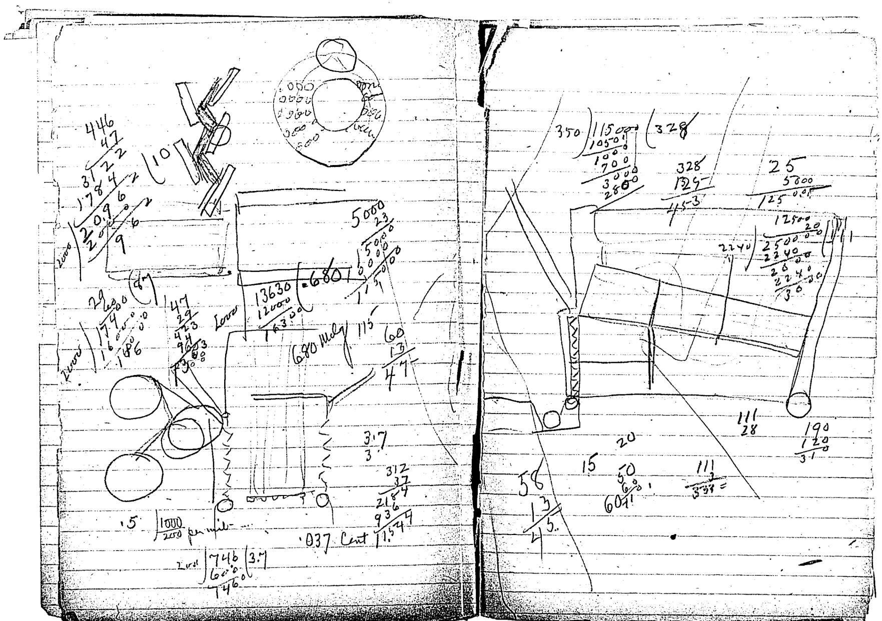
35
45
83
55 Cleaning

850
30
170

170
30
510

170
160
1020

83
30
230
170
60



446
5000
13630
12000
1630
.6801
680 Mdg
115
.037 Cent
1000
200 per mile
746
3.7
350
11500
328
25
5000
125
12500
2240
111
28
190
120
20
15

24
600

1.44
288 24
5
144 120
17.2 50
60

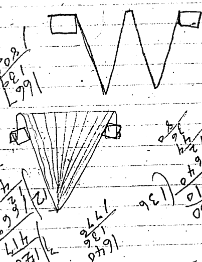
17.25 (1.15
50
8625
746
1201 146
117
446) 892
1089

24
4
9.6 50
48

1985 (21
446) 892
58

24) 300 (10
29
12

2.5 to 1



1250
1667

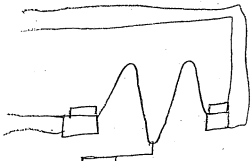
3)1250
417
1667 (139

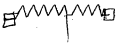
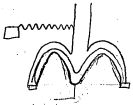
12) 1667
1640
136
1776

3)1230
410
1640 (136

Iron 20
Ni 21
Cells 6
Water 19
Ratio 2

1.15) 680 (69
575
1030
920
1 3



20
20
40
40
160
27) 960 (36
81
1320

36
3
108